SafeCheck 200
O_2/LEL Gas Monitor

Operator's Manual

Note: Due to the new ATEX Directive in Europe, all references in this document to "Ex" or "EEx" for intrinsic safety approvals should be disregarded effective 7/1/03 within the member countries of the European Union (EU). At this time, this product is not approved in accordance with the new ATEX Directive and is not sold for use in hazardous atmospheres or explosive zones by customers within the EU. Outside of the EU, all references to intrinsic safety continue without change.

QUEST TECHNOLOGIES

Thank you for choosing Quest Technologies to meet your personal gas monitoring needs. The SafeCheck 200 is a non-datalogging, easy to operate, rugged personal gas monitor that will measure and alarm for hazardous levels of oxygen and combustible gases. It is our goal to make your decision to buy Quest products the right one, and to provide support for any questions or concerns that might arise.

The purpose of this manual is to provide the user with the necessary information to operate the SafeCheck 200. The entire manual should be read to fully understand the many features this instrument offers.

This manual is not all inclusive and cannot cover all unique situations. In addition, no warranties are contained in this manual except as described under the warranty policy section.

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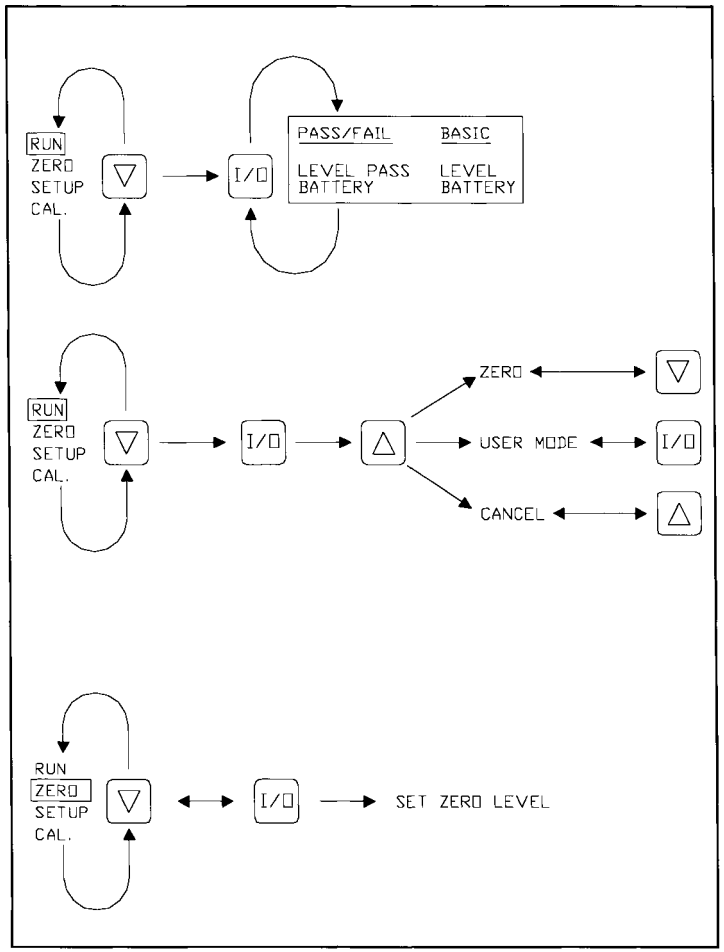


Figure 1. *Run and Zero Menus*

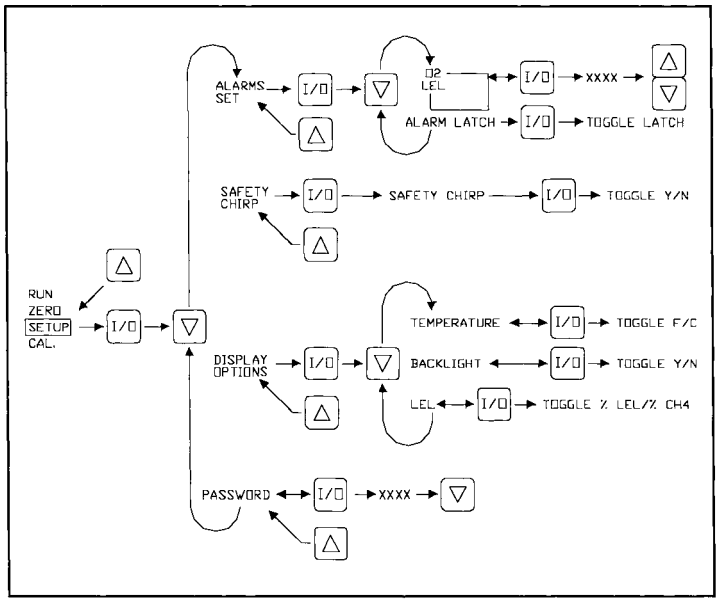


Figure 2. *Setup Menu*

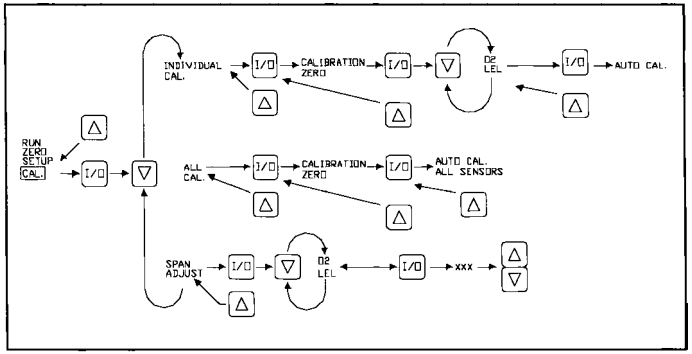


Figure 3. *Calibration Menu*

1. INTRODUCTION

The SafeCheck 200 is a compact, personally worn, two gas monitor that can simultaneously measure oxygen and combustible gas. Sturdy, lightweight, and easy to operate, this unit is ideal for industrial use.

Warning: The SafeCheck 200 is intended to measure gases that are potentially dangerous to human health. To help ensure worker safety through the proper use of your unit, it is important that you not only read but also understand the contents of this manual. Please familiarize yourself with the unit before using it in a potentially hazardous situation.

Caution: Underwriters Laboratories, Inc. has assessed only the combustible gas portion of this instrument for performance.

Note: When used with alkaline batteries in Canada tested per CSA (Canadian Standards Association) Standard C22 No. 152, Combustible Gas Detection Instruments are to be used in Canada only with the following "C" size alkaline batteries:

Eveready:	E93
Duracell:	MN1400
Rayovac:	814
Radio Shack:	23-551

Note: When used with alkaline batteries in Europe can only be used with:

Rayovac:	No.814LR14
Varta:	No. 4041 LR14.C
Duracell:	MN1400LR14

2.1 Unit Overview

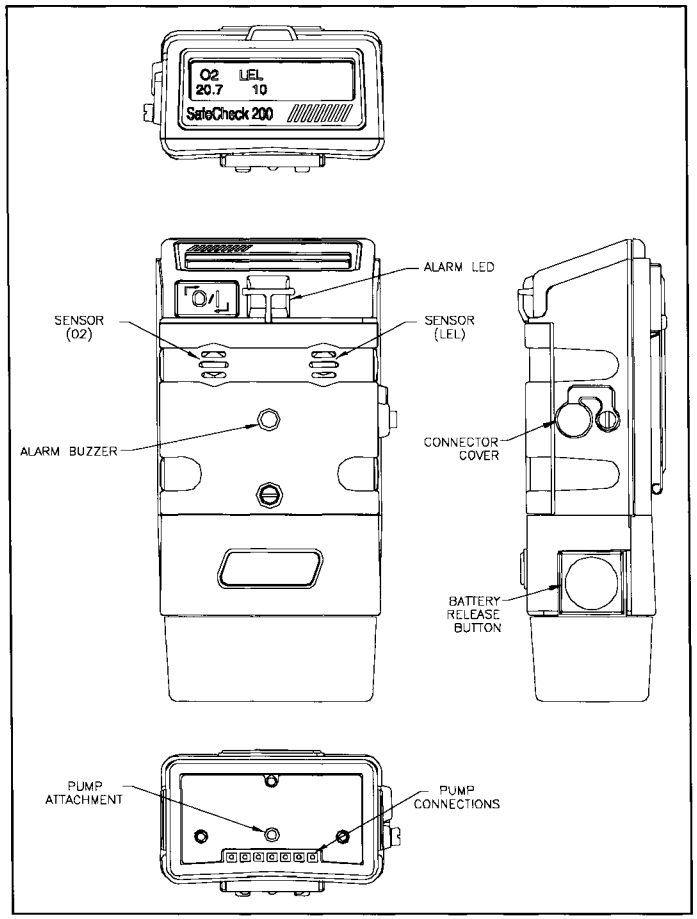


Figure 4. *Unit Overview*

2.2 The Keys:

In order to make the operation of the SafeCheck 200 as simple as possible, you only need to use three keys to perform all of the necessary operations.

This key is found on top of your unit above the display screen. You will use it to turn the unit on, to turn the unit off, and to select your desired menu choices when they are highlighted.

▼ ▲ These keys are located above the belt clip. You will need to use the arrow keys to change the unit's modes, and during the ZERO, SETUP, and CAL operations. You generally use the ▲ arrow to return to the previous screen and to adjust numeric values. You generally use the ▼ arrow to scroll through and highlight menu items, and to select and adjust numeric values.

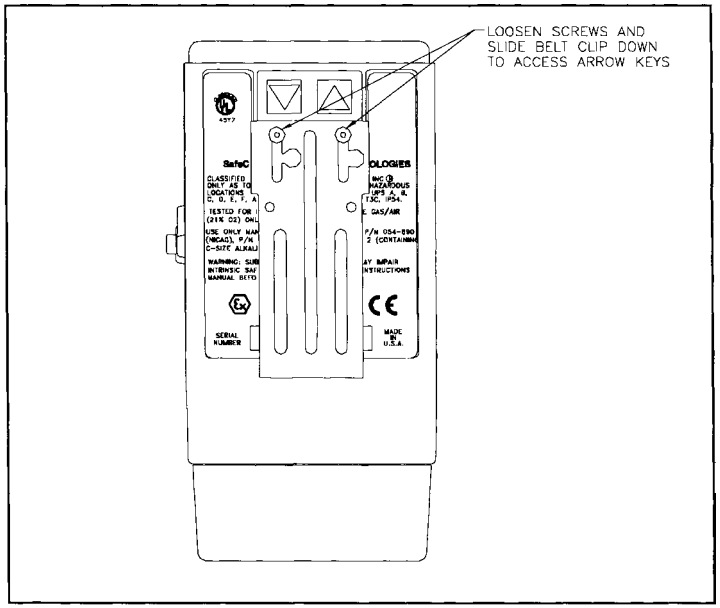


Figure 5. *Accessing the Arrow Keys*

2.3 Backlight:

The unit features a backlight which illuminates the screen for 10 seconds each time a key is pressed. Refer to Section 3.4.3 Setup under Display Options on page 14 to enable/disable the backlight illumination feature. The backlight also illuminates for 10 seconds any time the unit goes into alarm.

2.4 Alarm and Level Definition:

All of the following levels and alarm levels are based on the measurement of one sample per second. Refer to Section 3.6.3 Setup under Alarms Set on page 13 to change any of the alarm activation levels.

2.4.1 Oxygen Alarms and Levels:

Both oxygen deficient atmospheres and oxygen rich atmospheres present gravely hazardous work conditions.

• Low: The Low alarm level for oxygen is any level less than 19.5%. Oxygen deficiency is the leading cause of worker fatality during confined space entry, therefore the importance of monitoring the oxygen level cannot be overstated.

• High: The High alarm level for oxygen is any level greater than 23.5%. Oxygen rich atmospheres can lower the combustible range of some gases and can cause them to burn violently.

2.4.2 Combustible Gas Alarms and Levels:

Combustible gas levels can be measured as a percent of the LEL or as a percent by volume of CH_4 (methane). Refer to Section 3.4.3 Setup under Display Options on page 14 to change the way that combustible gas levels are measured.

• LEL: LEL stands for Lower Explosive Limit. An atmosphere which contains less than the LEL, the value of which varies among the combustibles is referred to as a lean atmosphere. An atmosphere which exceeds the UEL, or Upper Explosive Limit, the value of which also varies among the combustibles, is referred to as a rich atmosphere. The range between the LEL and the UEL is the combustible (explosive) range.

The default alarm level is set to 10% of the LEL. When this level is reached or exceeded, the unit goes into alarm. If the measured level exceeds 98% of the LEL, the alarm automatically latches on and the unit will remain in alarm until the unit is taken out of the RUN mode. When this occurs, a high probability exists that the gas concentration is above the LEL, in the combustible range, and overloading the LEL sensor.

• CH_4: This is a mode where the unit is set up to measure a specific combustible gas, methane (CH_4) in a percent by volume concentration rather than a percent LEL concentration. This is just a different way of reporting the concentration of one specific gas (CH_4). When CH_4 is at 5.0% by volume, it is also at 100% of it's LEL point.

The default alarm level is set to 0.5% by volume CH_4. When this level is reached or exceeded, the unit goes into alarm. If the measured level exceeds 4.9% of CH_4, the alarm automatically latches on and the unit will remain in alarm until the unit is taken out of the RUN mode. When this occurs, a high probability exists that the gas concentration is above 5.0% by volume, in the combustible range, and overloading the combustible gas sensor.

ALTHOUGH A RICH ATMOSPHERE MAY NOT PRESENT IMMINENT DANGER OF IGNITING AT THE TIME OF CURRENT MEASUREMENT, ANY DILUTION OF THIS RICH ATMOSPHERE COULD BRING THE CONCENTRATION DOWN INTO THE COMBUSTIBLE RANGE.

3. OPERATION

3.1 Turning the Unit ON:

Press the I/O key once to turn on the unit. The unit will then go through an internal self test and startup routine. During this startup routine the back-light will illuminate, the LED alarm light will turn on and the audible alarm will sound. Your unit will determine which sensors are installed, what their current alarm levels are, and the current battery pack voltage.

After the initialization screens, the main menu automatically appears. The first highlighted item is ZERO. At this time you can zero the umt's sensors by simply pressing the I/O key. We recommend that you zero the unit at this time ***provided that you are in a non-hazardous clean-air environment***. To reduce the chances of the unit being zeroed in a contaminated environment, only small automatic adjustments are allowed in this main menu ZERO function. If the adjustments necessary to zero the sensors are more than the unit will allow, a message will appear indicating which sensor or sensors cannot be zeroed followed by a "Zero Failure" message. In this case, the instrument must be zeroed under the Cal. main menu function. If no main menu selections are made, the unit automatically will go into the RUN mode after 30 seconds.

Run	Setup
Zero	Cal.

If you turn the unit ON and there are no sensors in place, the unit will not go into any of the modes that depend on sensors being there (e.g. RUN, ZERO, or CAL).

3.2 Turning the Unit OFF:

To turn the unit OFF, the unit must be in the main menu. If in the run mode, exit to the main menu by closing the session. Refer to Section 3.4.1 Run on page 11. Then press and hold down the I/O key. The screen will display a three second countdown and will beep once per second. When the screen goes blank and the alarm is on steady, you may release the key. The unit is now OFF.

3.3 User Modes:

The SafeCheck 200 has two modes: BASIC and PASS/FAIL.

You may change your unit's mode at any time while it is in the RUN mode. To do so, simply press the up arrow key located above the belt clip. The screen provides you with three options. Pressing the I/O key changes the unit to the next user mode. Repeat this process until the unit is set for the desired user mode.

3.3.1 Basic Mode:

In this mode, the screen displays which sensors are installed in your unit. Under each sensor indicator, its current level is displayed in percentage. When a gas level reaches or exceeds an alarm level, the alarm light will flash, the buzzer will sound, and the display will revert to displaying the reason for the alarm (High or Low). The gas that caused the alarm will alternately display the value of the gas and "*AL*".

By pressing the I/O key during this mode, you may switch to an additional screen that displays the unit's battery voltage.

3.3.2 Pass/Fail Mode:

In this mode, the screen displays which gas sensors are installed in your unit. The word PASS is displayed if none of the alarm levels have been exceeded. When a gas level reaches or exceeds an alarm level, the alarm light will flash, the buzzer will sound, and the display will revert to displaying the reason for the alarm (High or Low). It also shows a numerical display of the gases in percentage and the gas that caused the alarm will alternately display the value of the gas and "*AL*".

By pressing the I/O key during this mode, you may switch to an additional screen that displays the unit's battery voltage.

3.4 Main Menu:

When you turn on the unit, the main menu appears on the screen after the SafeCheck 200 completes its power-up sequence. You may return to this menu anytime when in RUN by holding down the I/O key for three seconds. The unit displays a message "Session Stop In x Seconds" with a countdown. After these three seconds, the unit will display a message "Session Closing..." You can release the I/O key and when the session finishes closing, the unit will be in the Main Menu. The item which appears with a blinking cursor on the first character will be referred to as the highlighted item (it is underlined in this manual).

To move through the main menu use the down arrow key located behind the belt clip. When the menu choice you want is highlighted, press the I/O key to select that choice. ZERO is always the first highlighted menu item. IF YOU ARE IN A CLEAN AIR ENVIRONMENT, you may zero the unit at this time by pressing the I/O key. After zeroing, or if a main menu selection is not made, the unit will automatically enter the RUN mode in about 30 seconds.

Run	Setup
Zero	Cal.

3.4.1 Run:
Before running, you should zero and calibrate your SafeCheck 200 in a non-hazardous area (an area away from your potentially hazardous work space, free from heavy traffic, excessive cigarette smoke and industrial fumes) before entering the work environment. Do not compromise safety by failing to take these steps prior to use.

Enter the RUN mode by selecting RUN from the main menu. Alternatively, the SafeCheck 200 will automatically go into the RUN mode in about 30 seconds after zeroing the unit or if a main menu selection is not made with in 30 seconds after the unit is turned on.

During the RUN mode, the LCD screen displays which gas sensors you have installed and during the BASIC mode, it displays their respective current gas levels in percentage. Refer to the Section 3.3 User Modes on pages 9 & 10 for information on what is displayed for the two different modes: BASIC or PASS/FAIL.

O2	LEL
20.9	0

Pressing the I/O key once during the RUN mode will turn on the backlight for 10 seconds. Pressing it again will display the battery voltage.

Pressing the ▲ arrow key during the RUN mode allows you to zero the unit or change the user mode. Press the ▼ arrow key to zero the unit. Press the I/O key to change the user mode. Press the ▲ arrow key to cancel and make no changes. This zero function works the same as the one in the main menu and only allows small automatic adjustments to be made in case the zero is being attempted in a contaminated environment.

▼=Zero	I/O=User
▲=Cancel	Mode

Exit the RUN mode by holding down the I/O key for three seconds. The unit displays a message "Session Stop In x Seconds" with a countdown. After these three seconds, the unit will display a message "Session Closing..." You can release the I/O key and when the session finishes closing, the unit will be in the Main Menu.

3.4.2 Zero:
Perform this operation in a non-hazardous area prior to every use to adjust for the sensors' sensitivity changes which occur over time and after use.

Fresh, uncontaminated air is necessary for the proper outcome of this procedure. (Zero the unit away from heavy traffic, excessive cigarette smoke, and industrial fumes.) If such an atmosphere is difficult to reach, zero air cylinders are available.

Once you have turned on the unit, ZERO is automatically highlighted when the screen displays the main menu. At this time you can zero the unit's sensors by simply pressing the I/O key. We recommend that you zero the unit at this time PROVIDED THAT YOU ARE IN A NON-HAZARDOUS CLEAN-AIR ENVIRONMENT. To reduce the chances of the unit being zeroed in a contaminated environment only small automatic adjustments are allowed in this main menu ZERO function. If the adjustments necessary to zero the sensors are more than the unit will allow, a message will appear indicating which sensor or sensors followed by a "Zero Failure" message. In this case, the instrument must be zeroed under the CAL. main menu function. If a "Zero Failure" message appears for any sensor, the ZERO procedure is aborted and any key pressed will return to the main menu. Unless any menu selections are made following completion of the ZERO function, the unit automatically goes into the RUN mode after 30 seconds. Once in the RUN mode, the unit can be zeroed by pressing the ▲ arrow key to pull up the RUN ZERO menu and the ▼ arrow to zero the unit. Remember, however, that the same small adjustment range is also present in RUN ZERO.

When zeroing, the screen will display "Zeroing Unit" and then "Unit Zeroed". This indicates that each sensor has been zeroed to the background atmosphere. When the oxygen sensor has been zeroed in a clean air environment, it has also been effectively calibrated since fresh air contains 20.9% oxygen.

3.4.3 Setup:
After turning the unit on, move through the main menu using the ▼ arrow key until SETUP is highlighted. Press I/O, and the screen will ask you to enter a four digit numeric password. For first time users or for users who have forgotten their password, a default password was created. This four digit default password is 9157.

The blinking cursor appears in place of the first digit. Press the ▼ arrow key to scroll through the numbers from 9 down to 0. Once you have reached the number you want, press I/O, and the blinking cursor will appear in place of the next digit. Repeat this process until the entire 4 digit password appears on the screen. Then, when you press the I/O key, you will have successfully accessed the SETUP menu.

```
Enter
Password:  ■---
```

The following items, will be found in the SETUP menu: Alarms Set, Safety Chirp, Display Options, and Password. Press the ▼ arrow key to cycle through them. Press the I/O key to select the highlighted item.

```
Alarm Set
Safety Chirp
```

As you are moving through most of the setup sub-menus, pressing the up arrow key will return you to the previous menu.

• Alarms Set:
There are alarm activation levels for each of the sensors. While you may alter any of the alarm activation levels, we recommend that you use the default values which have been programmed into the unit. These values are listed under Section 7. GAS SPECIFIC DATA on page 27.

```
O2       LEL
Alarm Latch  N
```

Within the Setup menu, access ALARMS SET by pressing the I/O key when ALARMS SET is highlighted.

To change the alarm activation levels, first highlight a sensor using the ▼ arrow key and then select it by pressing the I/O key.

For the OXYGEN sensor, both HI and LOW alarm activation levels can be set.

```
O2  HI   Alrm  23.5 ▲▼
    LO   Alrm  19.5
```


For the combustible gas sensor (either LEL or CH_4), the HIGH LEVEL alarm activation level can be set.

```
LEL    Alarm
Level:    10% ▲▼
```

When Alarm Latch is highlighted, pressing the I/O key will change between Y (yes) or N (no). This allows you to select whether the alarm will turn off as soon as the hazard goes away (N) or whether the alarm will latch (Y) until you acknowledge it by pressing the I/O key. Once your selection is made, press the ▲ arrow key to return to the SETUP menu or the ▼ arrow key to change any of the sensor's alarm activation levels.

```
O2   LEL
Alarm  Latch   N
```

• Safety Chirp:
The SAFETY CHIRP feature, when enabled, provides an audio beep every 10 seconds in the RUN mode to inform the user that their unit is turned on and is currently running.

Use the ▼ arrow key to move through the setup menu until you reach SAFETY CHIRP Press the I/O key to access the safety chirp menu. In this menu you have the options of enabling or disabling the safety chirp.

```
Safety Chirp    Y
```

To select whether or not the safety chirp feature is turned on, press the I/O key while SAFETY CHIRP is highlighted. The letter on the right will change between Y (YES) and N (NO).

• Display Options:
This menu allows you to select whether or not you wish to use the back-light option. It also allows you to select whether to display the combustible sensor (if present) as % LEL or % CH_4 (methane) by volume.

Select DISPLAY OPTIONS from the SETUP menu. Use the ▼ arrow key to select BK_LIGHT or LEL. With BK_LIGHT highlighted, pressing the I/O key will change between Y (YES) and N (NO).

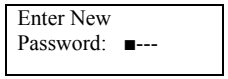
The backlight option will illuminate the screen for 10 seconds each time a key is pressed during the RUN mode and the MAIN menu, when turning the unit on and off, and when the unit goes into alarm. The backlight is useful in low-light areas but will not be noticed in bright areas.

```
Bk_Light       Y
LEL = % of CH4
```

The other option in the DISPLAY OPTIONS menu is LEL. This allows you to select the way that the gas reading from the LEL (Combustible) sensor will be displayed. With LEL highlighted, pressing I/O will change between % of LEL or % of CH_4 by volume. As % of LEL it will display as a percentage of the Lower Explosive Limit from 0 to 100%. As % of CH_4 it will display as a percentage of the volume of CH_4 (methane) that is present in the environment from 0.0 to 5.0%. Note: 5,0% by volume of CH_4 is also 100% LEL for CH_4. Press the ▲ arrow key to return to the setup menu.

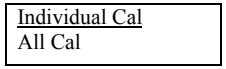
• Password:
This menu item allows you to set or change your unit's password. The password is necessary to enter the setup mode and change any of the unit's setup parameters.

Use the ▼ arrow key to move through the setup menu until PASSWORD is highlighted, then press I/O. Enter the new password using the ▼ arrow key to change the digits and the I/O key to set them. After the last digit is entered, you will be asked to re-enter the same password as a check. If they match, the display will show PASSWORD ACCEPTED and then return to the setup menu. If the re-entered password does not match the initial one, you will be asked to begin again. Pressing the ▲ arrow key at any time will return to the main setup menu.

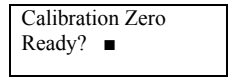


3.4.4 Calibration:
This should be done for each installed sensor prior to entering your work area. An uncalibrated unit can be as dangerous as no unit at all. Failure to calibrate can result in inaccurate sensor readings.

From the main menu, press the I/O key while CAL. is highlighted The following items, will be found in the CAL. menu: INDIVIDUAL CAL, ALL CAL, and SPAN ADJUST. Press the ▼ arrow key to cycle through them. Press the I/O key to select the highlighted item.



• Individual Cal: The unit first waits to do a CALIBRATION ZERO. This is automatically done before any calibration to adjust for drift in the sensor's sensitivity, which occurs over time and after use.

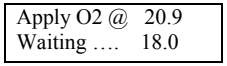


Note: Fresh uncontaminated air is necessary for the proper outcome of this procedure. (Zero the unit away from heavy traffic, excessive cigarette smoke, and industrial fumes.) If such an atmosphere is difficult to reach, zero air cylinders are available.

Press the I/O key when you are sure that you are in a clean air environment. The unit goes through and automatically zeros all the installed sensors.

The installed sensor list now appears in the top line of the display. The second line gives you the date of the last calibration for the highlighted sensor. Use the ▼ arrow key to scroll through the sensors. Press I/O to access the highlighted gas calibration menu.

At this point the unit takes over and runs the calibration. On the display, the unit asks you to apply the concentration of calibration gas that was specified in Span Adjust on page 19. The second line displays the message "Waiting....." along with the current concentration.



Place the calibration cup over the unit's sensors on the SafeCheck 200. Screw the regulator onto the calibration gas cylinder.

Connect tubing between the regulator on the gas cylinder and the calibration cup on the SafeCheck 200. Open the regulator as far as it will turn and gas should begin flowing over the sensors. Once the level of gas begins to rise, the second line of the display will change to "Detected" and the number next to it will begin to rise. Once the rise in the gas level starts to slow down and reach a stable level, the unit displays the message "Stabilizing". When the unit determines that the gas level has stabilized and no longer rising, the unit will do a calibration. It will display a message "Calibrating" and if successful "Calibrated". If calibration is not successful, the unit will indicate "Cal Failure". Check your calibration setup and calibration gas and then attempt another calibration. If the unit still cannot calibrate, either replace the sensor or have the unit serviced.

During the calibration procedure it also shows you the level of gas that the sensor is detecting. At anytime during the calibration procedure, calibration can be terminated by depressing any key. At the conclusion of a successful calibration for a gas, depress the I/O key or the ▲ arrow key to return to the sensor list screen.
Repeat the procedure, as necessary, for any other gases being measured.
To return to the main CAL. menu, press the ▲ arrow key.

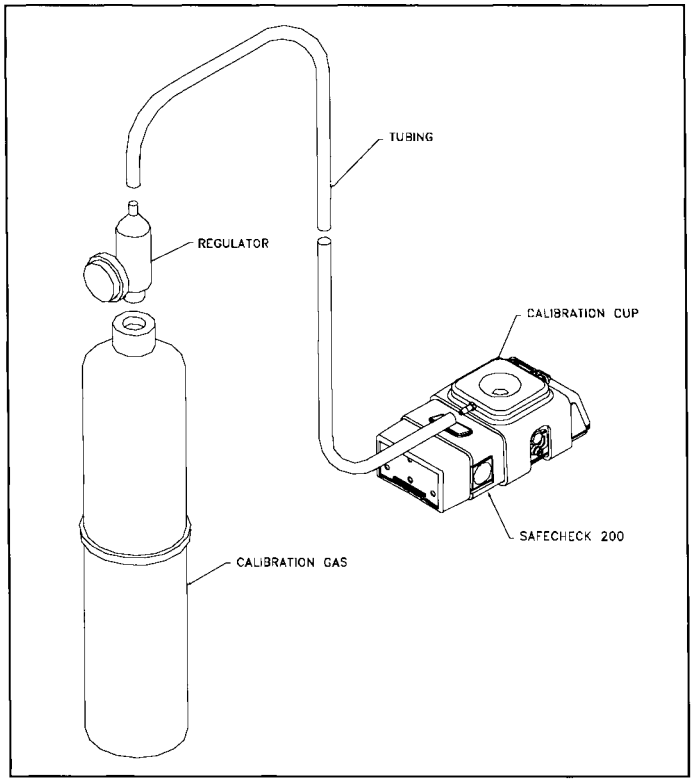


Figure 6. *Calibration*

• All Cal:

This operates the same as INDIVIDUAL CAL except that it steps automatically through all of the installed sensors to calibrate all of them. The unit first waits to do a CALIBRATION ZERO. This is automatically done before any calibration to adjust for drift in each sensors' sensitivity which occurs over time and after use.

Calibration Zero Ready? ■

NOTE: Fresh uncontaminated air is necessary for the proper outcome of this procedure. (Zero the unit away from heavy traffic, excessive cigarette smoke, and industrial fumes.) If such an atmosphere is difficult to reach, zero air cylinders are available.

Press the I/O key when you are sure that you are in a clean air environment. The unit goes through and automatically zeros all the installed sensors.

It now instructs you to apply the gas to the unit. Apply the calibration gas for sensor #1 in the unit and press the I/O key. It is very important at this point if an O_2 sensor is installed and the calibration level used is some thing other than 20.9% that you apply the calibration gas before pressing the I/O key. Not adhering to this procedure in this case will result in an incorrect calibration for O_2.

Apply Gas … Enter to Cal.

At this point the unit takes over and runs the calibration. It asks that you apply gas for the first sensor it finds. On the display, the unit asks you to apply the concentration of calibration gas that was specified in SPAN ADJUST, showing the expected value and displaying the message "Waiting". From here on, it operates just like INDIVIDUAL CAL and steps through each gas in turn asking you to apply each gases' cal. level until it is done or you abort the process.

• Span Adjust:

This menu allows you to set the concentration of the calibration gas used to calibrate each of the sensors. The unit then uses the concentrations entered here during either of the calibration options. When Span Adjust is selected from the main CAL. menu, the installed sensor list appears in the top line of the display. The first sensor installed is highlighted and it's calibration concentration appears. Using the ▼ arrow key to move across the top line will step through and show the calibration concentration for all installed sensors.

O2	LEL
20.9	

To change a calibration concentration use the ▼ arrow key to select a sensor and press the I/O key. Use the arrow keys to change the calibration concentration and the I/O key to accept it.

O2 Span:20.9
Use ⬍ to change

4. QuestSensor INFORMATION

The SafeCheck 200 has the capacity for an oxygen sensor and a combustible sensor. Each one of these sensors is an intelligent sensor and contains information pertinent to it's operation. Information relating to alarm setpoints are stored in the sensor. You may install less than two sensors, and your unit will still perform all of the necessary functions for the gases you need to monitor.

The unit can simultaneously handle the following QuestSensor combinations:

1. Up to two, a combustible sensor and an oxygen sensor.

The oxygen sensor and the combustible sensor each have their own particular sockets into which only they will fit.

Note: If using less than two sensors in the SafeCheck 200 a dummy sensor (054-899) must be placed in the empty sensor position to maintain the unit to environment sealing capability.

4.1 Changing or Installing the QuestSensors:

Note: Turn the unit off before performing this operation. Install the sensors in a non-hazardous area. When you change the sensors, remember to calibrate them after a warm-up period of several hours, which allows them to stabilize.

Using a screwdriver, loosen the quarter turn fastener which secures the unit's sensor cover.

The oxygen sensor only fits in the position labeled Sensor 1. Line up the pins with the socket and press it in.

The combustible sensor only fits in the position labeled Sensor 2. Line up the pins with the socket and press it in.

Once the sensors are in place, replace the cover and tighten the 1/4 turn fastener to secure the cover.

5. BATTERY INFORMATION

5.1 Replacing or Installing the Batteries

Turn the unit off before performing this operation. Please dispose of old batteries in an appropriate manner.

Three different removable battery packs are available for your SafeCheck 200. Sealed packs containing rechargeable NiCad (Nickel Cadmium) or NiMH (Nickel Metal Hydride) batteries are available as well as a pack, which will hold two disposable "C-size" alkaline batteries. These battery packs, which are labeled as to which type they are, are interchangeable and the packs can be removed from the unit and replaced while in a hazardous environment.

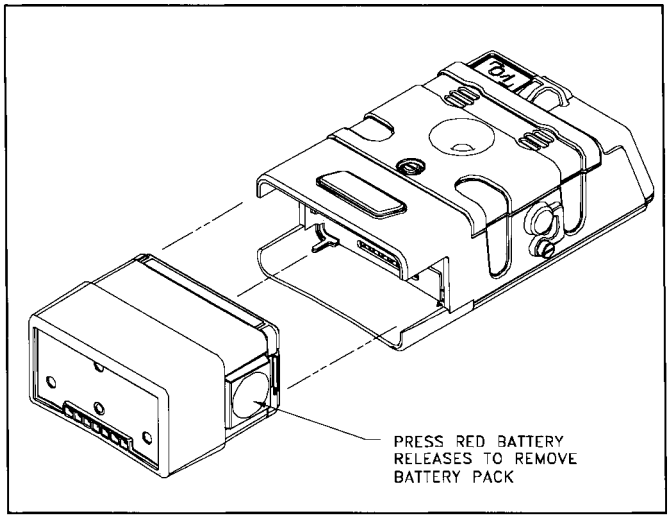


Figure 7. *Battery Replacement*

Caution: Only fully assembled alkaline packs may be removed or replaced in a hazardous environment. Alkaline packs may not be opened for battery replacement in a hazardous environment. In addition, any attempt to use rechargeable batteries in the alkaline battery pack will void any intrinsic safety approvals and substantially reduce unit

Caution: Any time the battery pack is removed and then replaced, your unit is designed to turn itself on. This is to insure that, in the case of an accidental power interruption, the unit comes back on to safeguard worker protection. Therefore, any time that the battery pack is removed and then replaced, it is necessary to manually turn off the unit unless you are going to immediately use the instrument.

The unit should be turned off before changing a battery pack. The pack is held in firmly by two spring clips located on either side of the battery. To remove the pack, depress the two spring clips and pull the pack away from the main housing. To replace the battery pack, position the pack such that contacts on the pack are in line with the pins in the housing and gently push the main housing and pack together until both spring clips lock in place. The pack is keyed so it only goes in one way.

5.2 Low Battery Warnings

When the battery voltage is reduced to approximately 2.2 volts, the alarm will sound and the display will indicate "**LOW BATTERY** ALARM". At this point the battery alarm can be silenced up to two times for a period of one minute each before the alarm will turn on and stay on until the unit is shut off. When low battery is indicated, you need to shut the unit off and replace or recharge the battery pack.

If operation of the unit is continued until the battery voltage gets down to 2.1 volts, the alarm will sound and the display will indicate "DEAD BATTERY SHUTDOWN". At this point the alarm cannot be silenced and it will stop monitoring the environment. When this occurs you need to turn the unit off and replace or recharge the battery pack. If this is not done, after approximately thirty seconds the unit will turn itself off. This extra protection feature is included to provide an orderly shutdown of the program that controls the unit and ensure that essential values are saved in the unit's memory.

5.3 Recharging NiCad and NiMH Battery Packs

We provide a charging station for the reconditioning of these battery packs. The battery packs may be charged with the Quest MultiCharger II either as part of the unit or may be removed from the unit for separate recharging.

Caution: ***The MultiCharger II is not approved for operation in a hazardous environment, so any attempt to charge a unit and/or a rechargeable battery in a hazardous environment is specifically cautioned against. In fact, if the unit is operated while connected to the charger in a hazardous location, all intrinsic safety approvals are voided.***

The MultiCharger II is designed to fully recharge a battery pack in less than two hours. When the pack is fully charged, the charger switches to a trickle charge to maintain the charge on the pack and to avoid damage to the pack by overcharging. In addition, there is a discharge button that can be used with the NiCad battery pack to fully discharge the pack before charging to counteract the affect of "battery memory" that is a problem inherent to NiCad batteries. As a guide, using this feature would discharge a fully charged NiCad pack in about six hours. With NiCad packs it is recommended that you do a discharge before charge cycle about every 10th charge cycle. This helps to lengthen the life of a NiCad pack especially if the pack is only partially discharged on a regular basis. There is no requirement to do the conditioning discharge/charge cycle on the NiMH battery pack, as this type of battery does not suffer from memory effects.

Note: Rechargeable SafeCheck 200 battery packs may only be charged with the Quest MultiCharger II battery charger. Use of other charger's could result in damage to either the unit or the battery pack. Likewise, attempting to charge other battery packs with a Quest MultiCharger II could result in damage to the charger.

5.4 Servicing Alkaline Battery Packs

The alkaline pack is designed to hold two "C Size" alkaline batteries. The cover on the pack is held in by three captive Phillips head screws. The pack is opened by undoing the screws and gently removing the cover. Make sure to observe the polarity markings in the battery pack to insure that the batteries are inserted correctly.

Caution: ***Only fully assembled alkaline packs may be removed or replaced in a hazardous environment. Alkaline packs may not be opened for battery replacement in a hazardous environment. In addition, any attempt to use rechargeable batteries in the alkaline battery pack will void any intrinsic safety approvals and substantially reduce unit run-time.***

5.5 Unit Storage With and Without Batteries

For short term storage, it is recommended that you leave the batteries in your unit. In a turned off unit, a fully charged rechargeable battery pack will last approximately 80 days while an alkaline pack will last approximately 140 days.

For long term storage keep a battery pack on the unit. Periodically replace the batteries if using the alkaline pack or recharge them if using rechargeable packs.

Note: It is recommended to keep a battery pack attached whenever possible to maximize the life of the internal lithium backup battery. The backup battery is not user replaceable.

6. FACTORS AFFECTING RESPONSE

6.1 Combustible Gas

The performance of the combustible gas sensor requires sufficient oxygen levels (at least 10%) to function properly. When monitoring combustible gases, always simultaneously monitor for oxygen, particularly in any application where a lean oxygen atmosphere could be present, as in a confined space.

6.1.1 Rich Atmospheres:

In a rich atmosphere, the combustible gas concentration is greater than the Upper Explosive Limit. Several dangers exist in an atmosphere rich in combustible gas. The introduction of fresh air, or simply the introduction of some method of air circulation, could dilute the concentration enough to bring it down into the combustible range. In addition, as the volume of combustible gas rises, its natural cooling effect, which varies from one gas to the next, reduces the temperature of the sensor filament and a lower reading is usually the result.

6.1.2 Oxygen Dependence:

The presence of oxygen in the sampled atmosphere is necessary for the proper measurement of the combustibles. If sufficient oxygen is not present, the measurement of combustible gases could be thrown off so drastically that hazardous levels could be present and they would not be detected.

6.1.3 Pocketing:

Lean mixtures may collect or be trapped in an area of the confined space such as corners, support beams or equipment and become flammable, therefore it is critical to test all areas and levels of a confined space for the presence of combustible gases.

6.1.4 Combustible (%LEL) Relative Sensitivity:

The following table shows the sensitivity of the LEL sensor to a number of other combustible gases. The values listed are relative to a calibration for 100% LEL for Methane.

Combustible Gas (LEL)	Relative Sensitivity	Combustible Gas (LEL)	Relative Sensitivity
Methane	100	Acetone	45
Propane	53	Methyl Ethyl Ketone	38
n - Butane	49	Toluene	40
n - Pentane	45	Ethyl Acetate	39
n - Hexane	43	Hydrogen	81
n - Heptane	37	Ammonia	126
n - Octane	35	Cyclohexane	40
Methanol	69	Carbon Monoxide	80
Ethanol	59		
Isopropyl Alcohol	39		

6.2 Oxygen:

The oxygen sensor can underestimate the amount of oxygen present if water vapor in the area has a higher temperature than the ambient temperature. To adjust for this situation, use the QTP-2000 Sample-Draw Pump to cool the air being drawn to the sensor, allowing the water vapor to condense and permitting sampling at a relatively constant temperature and humidity.

7. GAS SPECIFIC DATA

Note: Underwriters Laboratories, Inc. has assessed only the combustible gas portion of this instrument for performance.

Gas	Range	Reso-lution	Accu-racy*	Drift**	Alarm High***	Alarm Low***
Oxygen O_2	0.30%	0.1%	±5%	<1%	23.5%	19.5%

Gas	Range	Resolution	Accuracy*	Drift**	Alarm High***
Combustibles (LEL)	0-100%	1%	±5%	<5%	10%
Methane CH_4	0-5%	0.1%	±5%	<5%	0.5%

* Sensor accuracy, listed by City Technology, as a percentage of the reading. ** Long term output drift listed as percentage of signal loss per month
For the LEL sensor, refers to long term zero drift based on Methane
*** Factory default settings. Recommended for normal use.

8. SPECIFICATIONS

Size:	6.9" x 3.4" x 2.0" (17.5 cm x 8.6 cm x 5.1 cm)
Weight:	22 ounces (0.6 kg)
Power:	Nickel Cadmium Battery Pack - Rechargeable Nickel Metal Hydride Battery Pack - Rechargeable Alkaline Battery Pack - 2 "C" Cells (User Replaceable)
Battery Life:	10 hours/charge with the NiCad or NiMH battery pack. 16 hours with alkaline battery pack.
Sensors:	Combustible gases/methane (catalytic diffusion type) & oxygen
Sensor Configurations:	Oxygen and combustible
Measurement:	Continuous (one sample/second)
Display:	Two line alphanumeric backlighted LCD
Alarms:	Pulsating audio tone and flashing visual
Alarm Thresholds:	High level, Low level (O2 only), Low battery
Operating Indicator:	Safety chirp
Temperature Range:	-10 to 40°C (14 to 104°F) operating -15 to 60°C (5 to 140°F) storage
Humidity	0 to 99% relative humidity, non-continuous, non-condensing
Range:	15 to 90% relative humidity, continuous, non-condensing
Warranty:	Sensors 1 year, electronics 1 year
Cell Life Expectancy:	Oxygen sensor: 1 year Combustible gas sensor: unlimited

9. ACCESSORIES

9.1 Replacement QuestSensors:

54-872 Combustible Gas (LEL)
54-873 Oxygen (O2)
54-899 Dummy Sensor (required to cover socket when no sensor is present to maintain unit to environment sealing capability)

9.2 Accessories:

54-486 Protective Leather Case with Shoulder and Chest Strap
54-487 Protective Leather Case for Unit with Automatic Sample Pump
54-720 QTP-2000 Sample-Draw Pump includes 10 ft. of Hose with a Sample Gas Probe and Butyrate Wand
54-710 Sample Gas Probe for Pump with Butyrate Wand
11-609 Butyrate Wand for Sample Gas Probe
11-608 Stainless Steel Wand for Sample Gas Probe
54-301 Replacement Hydrophobic Filter for Pump Probe Assembly - Package of 5
54-948 Hand Aspirator and 10 ft. of Hose
54-898-A Single Unit Charger with 120V Transformer
54-898-B Single Unit Charger with 220V Transformer
54-898-C Single Unit Charger with 12VDC Automobile Adapter
54-725-A Dual Unit Charger with 120-220VDC Power Supply (includes 110V North American line cord)
54-725-B Dual Unit Charger with 120-220VDC Power Supply (includes 220V Continental European line cord)
54-725-C Dual Unit Charger with 12VDC Automobile Adapter
54-726-A Five Unit Charger with 120-220VDC Power Supply (includes 110V North American line cord)
54-726-B Five Unit Charger with 120-220VDC Power Supply (includes 220V Continental European line cord)
54-727 Charger Upgrade Kit: adds additional charger to existing charger. Allows up to a total of five, (requires 120-220VDC Power Supply)
54-890 NiCad (Nickel Cadmium) Battery Pack
54-891 NiMH (Nickel Metal Hydride) Battery Pack
54-892 Alkaline Battery Pack
54-714 Earphone
54-703 Calibration Adapter (Also used for Sample Draw w/Hand Aspirator)

54-963 Storage Case
54-965 Water Resistant Carrying Case

9.3 Calibration Kit:

54-974 Two-Cylinder Calibration Kit: Includes two-cylinder calibration case, regulator (specify which regulator), and tubing

9.4 Regulators:

54-971 0.5 1pm Regulator with 2' (.050" I.D.) tubing
54-326 On Demand Regulator for use with a Sample Draw Pump

9.5 103 Liter Steel Cylinder Calibration Gases:

54-137 2.5% Methane in Air
54-138 0.3% Hexane in Air
54-139 1.1 % Propane in Air
54-140 2.0% Hydrogen in Air
54-141 100% Nitrogen

10. MultiCharger II

Caution: ***The MultiCharger II may only be used when the SafeCheck 200 contains rechargeable Nickel Cadmium or Nickel Metal Hydride battery packs. If an alkaline battery pack is accidentally placed into the charger, it will not attempt to charge. No damage will be done to the charger. The MultiCharger II is not approved for operation in a hazardous environment, so any attempt to charge a unit and/or a rechargeable battery pack in a hazardous environment is specifically cautioned against. In fact, if the unit is operated while connected to the charger in a hazardous location, all intrinsic safety approvals are voided.***

We provide this charger for the reconditioning of the NiCad and NiMH battery packs. The battery packs may be charged either as part of the unit or may be removed from the unit for separate recharging.

The MultiCharger II is designed to fully recharge a battery pack in less than two hours. When the pack is fully charged, the charger switches to a trickle charge to maintain the charge on the pack and to avoid damage to the pack by overcharging. In addition, there is a discharge button that can be used with the NiCad battery pack to fully discharge the pack before charging to counteract the affect of "battery memory" that is a problem inherent to NiCad batteries. As a guide, using this feature would discharge a fully charged NiCad pack in about six hours. With NiCad packs it is recommended that you do a discharge before charge cycle about every 10th charge cycle. This helps to lengthen the life of a NiCad pack especially if the pack is only partially discharged on a regular basis. There is no requirement to do the conditioning discharge/charge cycle on the NiMH battery pack, as this type of battery does not suffer from memory effects.

Note: Rechargeable SafeCheck 200 battery packs may only be charged with the Quest MultiCharger II battery charger. Use of other charger's could result in damage to either the unit or the battery pack. Likewise, attempting to charge other battery packs with a Quest MultiCharger II could result in damage to the charger.

11. QTP-2000 SAMPLE-DRAW PUMP

The QTP-2000 Sample-Draw Pump may be used to test air prior to entering a confined space. Attach the pump to the SafeCheck 200 using the attachment screw located on the end of the pump. The pump starts automatically any time that the unit is in the RUN MODE or the CALIBRATE MODE. The pump will not run in any other mode to conserve unit battery power. Attach the Tygon tubing and sample gas probe as shown.

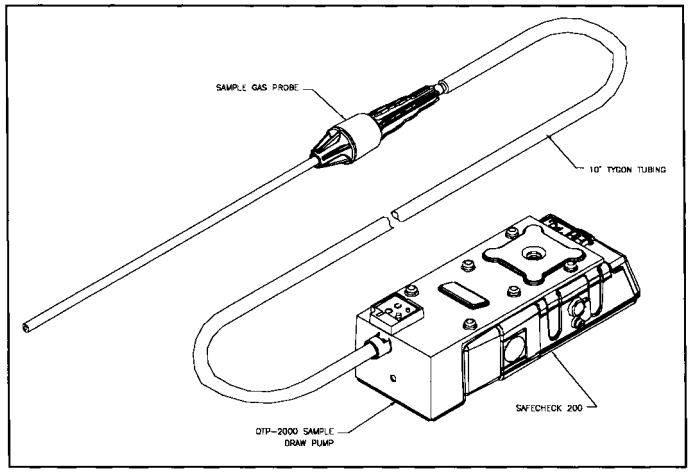


Figure 8. *Sample-Draw Pump*

The Sample Gas Probe contains a replaceable hydrophobic filter to prevent accidentally drawing water into the unit, and to prevent dust and solid objects from getting into the unit. The pump gets it's power from the unit and draws approximately 2.5 liters per minute. It is also controlled by the unit, in that if it becomes plugged or begins to draw in water, the unit will cause the pump to shut down and give an audible and visual indication that the pump is plugged.

QUEST SERVICE POLICY

Service Policy

The Quest product you have purchased is one of the finest gas detection instruments available. It is backed by our full one-year warranty, which seeks complete customer satisfaction. This is your assurance that you can expect prompt courteous service for your equipment from the entire Quest service organization.

Should your Quest equipment need to be returned for repair or recalibration, please contact the Service Department at (800) 245-0779 (USA) or Fax (262) 567-4047 for a Return Authorization Number. The RA number is valid for 30 days, and must be shown on the shipping label and purchase order/cover letter. If you are unable to return instruments in that time call for a new RA number. Send it prepaid and properly packed in the original shipping carton directly to Quest Technologies, 510 S. Worthington St., Oconomowoc, WI 53066 U.S.A.

Repair or replacement work done under warranty will be performed free of charge, and the instrument will be returned to you prepaid. Your copy or a photocopy of the Quest Registration Card will serve as proof of warranty should the factory require this information.

If for any reason you should find it necessary to contact the factory regarding service or shipping damage, please direct your calls or letters to the attention of the Service Manager, Quest Technologies, (262) 567-9157 or (800) 245-0779. Office hours are from 7 AM to 6 PM (Central Standard Time) Monday through Friday.

For service or recalibration outside the U.S.A., please contact your local Quest Dealer or fax Quest U.S.A. at (262) 567-4047.

QUEST WARRANTY POLICY

Warranty Policy

Quest Technologies warrants our instruments to be free from defects in materials and workmanship for one year under normal conditions of use and service. For U.S.A. customers we will replace or repair (our option) defective instruments at no charge, excluding batteries, abuse, misuse, alterations, physical damage, or instruments previously repaired by other than Quest Technologies. Microphones, sensors, and printers may have shorter warranty periods. This warranty states our total obligation in place of any other warranties expressed or implied. Our warranty does not include any liability or obligation directly resulting from any defective instrument or product or any associated damages, injuries, or property loss, including loss of use or measurement data.
For warranty outside the U.S.A., a minimum one-year warranty applies to the same limitation and exceptions as above with service provided or arranged through the authorized Quest distributor or our Quest European Service Laboratory. Foreign purchasers should contact the local Quest distributor for details.

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